

Nuclear Power Plant
Emergency Preparedness:

Protecting Our Neighbors in the Event of an Emergency




Teamwork



Regulations



Safety



The rewards are many. The risks are relatively small, and they can be reduced by good planning. That is the way people should assess nuclear power."

Rudolph Giuliani
Former New York Mayor
Nov. 17, 2003

Nuclear power plants are among the strongest industrial facilities—massive concrete and steel structures with backup safety systems, extensive security programs, federally licensed operators, and daily oversight by resident inspectors from the U.S. Nuclear Regulatory Commission.

Although nuclear plants are safe, with excellent operating records, we know that accidents can happen. To protect our workers, their families and the public, we devote extensive resources to planning our emergency response to operational and security-related events.

The nuclear energy industry's commitment to excellence, combined with continual training and testing, has produced an unparalleled level of emergency preparedness in America's industrial sector.

There are two basic steps in nuclear plant emergency preparedness. First, do what it takes to keep the plant safe. Second, determine in advance what to do if an event requires an emergency response. This booklet discusses both steps.



Safe

Nuclear Plant Safety: Defense in Depth

Nuclear power plants are built with “defense-in-depth” safety design and construction.

- The structure containing the reactor—called the containment building—is made of 4-foot-thick, steel-reinforced concrete. The reactor itself is housed in a massive steel vessel 4 to 8 inches thick and weighing more than 300 tons.
- Redundant safety systems are designed to maintain reactor safety at all times. This redundancy ensures that every measure taken to keep a plant safe can be done in two or more ways.
- Federally licensed operators ensure safe plant operation. These highly trained professionals train one week out of every five, and they must requalify for their licenses every two years. NRC regulations also require operators to participate in emergency preparedness drills and exercises.



Cutaway illustration of a typical power reactor.



Federal Regulations and Emergency Planning Zones

“*The NRC Operations Center, located at its headquarters in Rockville, Md., is continually staffed with qualified personnel, who have the expertise and ability to evaluate events and alert NRC management other federal partners and licensees, as necessary to properly respond to unfolding events. ...*

The NRC is capable of responding to multiple events, affecting multiple plants at the same time.”

Nils Diaz
NRC Chairman

In the event of an emergency, dedicated lines feed key plant operating data into the NRC emergency operations center.

Federal law requires every U.S. nuclear power plant to maintain and regularly exercise a detailed emergency preparedness plan to protect the public in the event of an accident at the facility. The NRC and the states in which the plants are located approve these plans. The NRC also coordinates with the Federal Emergency Management Agency. Each plant conducts a full-scale exercise every two years—involving federal, state and local officials—and conducts additional drills between these exercises.

The Federal Radiological Preparedness Coordinating Committee—including representatives from the NRC, FEMA and the Environmental Protection Agency—developed the basis for a radiological emergency program in 1978.

The committee's task force determined that a 10-mile radius around a nuclear power plant—illustrated on the center foldout—is an appropriate emergency planning zone (EPZ) in the event of a release of radioactivity from the reactor. The federal task force concluded that the public beyond the 10-mile radius of a nuclear plant is not at risk from direct exposure to any radioactive materials that may be released. However, authorities would take protective measures for other populations as needed.

A nuclear plant's emergency response plan must provide protective measures, such as sheltering, evacuation or consideration of distributing potassium iodide—which can protect the thyroid from radioactive iodine—for communities within 10 miles of the plant.



PHOTO COURTESY
OF NRC

Reg

This 10-mile area is divided into several sectors, each resembling a slice of pie. During an incident at a nuclear power plant, the chief sector of interest is the sector downwind of the plant. If a significant radioactive release were to occur, it would travel in the prevailing wind direction. Radioactivity in this air mass, or plume, would disperse to extremely low concentrations as distance from the plant increases.

If evacuation were necessary, emergency responders would focus on individuals most at risk of direct exposure to a radioactive release: nonessential plant personnel and residents within a two-mile radius of the plant, as well as those within five miles of the plant in the downwind sector. This is known as the “key-hole approach” to implementing protective actions.

Each year, the companies that operate nuclear plants provide vital information for residents, special needs populations, businesses, schools and other institutions, and tourist venues within 10 miles of each nuclear plant.

This information explains how state and local authorities will notify them in the event of an emergency at the nuclear plant and what protective measures they should take. The materials also provide basic information about radiation and its health effects.

The primary source for possible radioactive exposure to people beyond the 10-mile zone is through the food chain. The task force established a 50-mile radius to limit public exposure to radioactive materials through contaminated water, milk or food. State and local government plans are in place to support implementation of protective actions in the 50-mile zone around each nuclear power plant should that become necessary.

PHOTO COURTESY OF
WOLF CREEK NUCLEAR
OPERATING CO.



Training, teamwork and practice: Above, a community medical team participates in a drill.

ulations

Nuclear Plant Emergency Planning: Teamwork in Action

“Our emergency response defines the public’s trust in us and our ability to do business going forward. That makes emergency preparedness a critical function that deserves attention from the highest levels of management.”

Barnie Beasley
President and
Chief Executive Officer
Southern Nuclear
Operating Co.

Nuclear power plant emergency plans have a broad reach, involving at least 200 employees at each plant. NRC, state and local government and emergency response officials—including fire departments, law enforcement and traffic control authorities—also are included in the company’s plan and participate in periodic exercises to demonstrate the plan’s viability.

Ongoing communication and regular drills and exercises ensure that plant personnel and the community’s emergency response organizations are a finely honed team.

Roles and Responsibilities of Emergency Responders

In the event of a nuclear plant emergency, the company operating the plant classifies the event on an NRC-established scale and notifies local, state and federal emergency organizations within 15 minutes. The company also recommends protective actions for the public near the plant.

State and local officials are responsible for emergency response planning, public notification and implementing protective actions, if needed.



PHOTO COURTESY OF
DOMINION GENERATION

Nuclear plant staff and local
emergency responders drill together
to ensure close coordination.

Team

In an emergency, local and state emergency response organizations would confirm the severity of the event and determine what protective actions to take for residents within 10 miles of the plant. They must be able to activate notification systems within 15 minutes of learning about a situation requiring action.

The NRC staffs a 24/7 emergency response center. The NRC chairman or another commissioner is on call at all times to coordinate the agency's response to any emergency.

Under the Department of Homeland Security's National Response Plan, federal resources will be made available if needed by state and local emergency response organizations.

Nuclear Plant Event Classifications

The NRC established a classification scale for nuclear power plant events to ensure consistency in communications and response.

- A *notification of unusual event*, the lowest classification, means that a minor plant event—either an operational event or security threat—has occurred, but no radiation release is expected.
- An *alert* means that there is an actual or potential reduction in the plant's safety level or a security event that could threaten site personnel or damage plant equipment. No radiation release is expected.
- A *site area emergency* suggests a more serious event. Major safety equipment either has failed or is deemed likely to fail. There is the potential for a minor radiation release that would not exceed EPA safety standards.

- A *general emergency* is the most serious event. In this instance, radiation may leak outside the plant and beyond the plant boundary.

The only general emergency that has ever been declared at a U.S. nuclear power plant was the 1979 accident at the Three Mile Island plant in Pennsylvania. The most recent site area emergency occurred in 1996.

Evacuation and Sheltering

The company that operates a nuclear plant is responsible for recommending to local government officials protective actions for the public in the event of an emergency at the

NRC reactor safety experts and communicators work as a team during a nuclear plant emergency exercise.



PHOTO COURTESY
OF NRC

facility. Local officials then determine what actions to take.

- The primary protective actions are evacuation and sheltering to protect residents from any type of radioactive exposure.
- If there were a radioactive release, the most probable exposures would come from radioactive noble gases. These gases do not concentrate in the body.
- The company involved must consider recommending the use of potassium iodide within the 10-mile zone, although it is state and local governments that decide whether to stockpile and use it. Potassium iodide can protect the thyroid gland in the event of a radioactive iodine release from the plant. However, it does not protect any other part of the body, or against any other type of radioactivity.

Examining Evacuation Safety

A 2004 study by Sandia National Laboratory found that large-scale evacuations are “very effective and successfully save lives and reduce the potential number of injuries associated with the hazard.” The finding held true whether the evacuations were planned or ad hoc.

Starting with a sample of 230 large-scale evacuations between 1990 and 2003, Sandia selected 50 for detailed case studies. They included five evacuations of more than 100,000 people, ranging from 270,000 to 666,000, both for hurricanes. One of the five was the Sept. 11, 2001, evacuation of lower Manhattan after the attack on the World Trade Center. The 50 detailed case studies also included 33 evacuations dealing with technological hazards. No radiological-related evacuations occurred during the time frame covered by the study.

The study found that close coordination among emergency responders, training and exercises contribute to the effectiveness of evacuations. All 50 communities provided training to their emergency response personnel; 40 percent conducted full-scale exercises.

The only event at a U.S. nuclear plant that has required full-scale emergency response was the 1979 accident at Three Mile Island. However, local government officials have successfully used the emergency response plans developed by the nuclear industry in other emergencies.

Traffic control authorities train and drill as part of the nuclear plant emergency response team.

Here are two examples:

- The evacuation of 10,000 people from Cedar Rapids, Iowa, in 1985, following a fire at a city-operated sewage treatment plant that dispersed a cloud of toxic fumes over the city. State and local officials used a draft plan developed for the Duane Arnold nuclear plant.
- The evacuation of 17,000 residents of St. Charles Parish, La., following a leak from a nearby chemical plant in 1982. State and local officials worked from a draft plan for Entergy’s Waterford 3 nuclear plant, which was not yet operating.



Regulatory Oversight of Emergency Preparedness

The NRC is responsible for safety oversight of nuclear power plants. The agency assesses reactor performance through a combination of inspections and data on 18 performance indicators. Three of these indicators pertain to emergency preparedness:

- emergency preparedness/drill and exercise performance
- the percentage of emergency response organization members who have participated in a drill or exercise
- the working order of alert and notification system sirens, as measured by periodic testing.

Every reactor receives at least 2,500 hours per year of NRC inspection, a portion of which is allocated to a review of the facility's compliance with emergency preparedness regulations. The NRC assesses its findings from these inspections to determine their safety significance.

The NRC posts the results for each performance indicator—along with inspection findings—on its Web site at www.nrc.gov.

“When a [protective action] recommendation comes from the plant, it has been researched and looked at by some good people. And their families live in our emergency planning zone.”

Ned Wright
Director, Linn County (Iowa)
Emergency Management



PHOTO COURTESY OF
DOMINION GENERATION

Although nuclear plants are safe, federal law requires each plant to maintain and regularly test an emergency plan.

“*Emergency preparedness is a partnership. ... Thousands of first responders from local communities make emergency preparedness work at the grass-roots level.*”

Eric Leeds
Director
NRC, Division of Preparedness
and Response

Nuclear Power Plants And Hurricane Katrina

When Hurricane Katrina—a Category 4 storm—struck the Gulf Coast in 2005, it directly affected two nuclear power plants in Louisiana and one in Mississippi. None of the plants experienced any significant damage or flooding.

Entergy's River Bend plant near Baton Rouge, La., and Grand Gulf plant near Jackson, Miss., safely produced electricity throughout the storm. The company's Waterford plant in St. Charles Parish near New Orleans shut down in advance of the storm, and the NRC authorized it to restart less than two weeks later.

Waterford's emergency planning procedures allowed Entergy personnel to coordinate closely with St. Charles and St. John parish emergency preparedness officials and the managers of other local industrial facilities. This protocol has been enhanced over years of training and exercising the emergency plan.

After the storm, recovery in St. Charles Parish was enhanced by the high level of expertise and cooperation demonstrated by local public officials and emergency responders.

Nuclear power plants are among the few power sources unaffected by destruction of surrounding infrastructure, interruptions in the transportation of fuel and other factors. Because nuclear power plants refuel every 18 to 24 months, they can operate despite prolonged interruptions that impact fuel supplies for other sources.

State-of-the-art technology, at left, enables the NRC to track weather systems that might affect nuclear plant operations. At right, Entergy repairs power lines after Hurricane Katrina.



PHOTO COURTESY
OF NRC



The Nuclear Energy Institute is an industry policy organization that fosters the beneficial uses of nuclear technologies worldwide.

The Institute's members include leading universities, research laboratories, radiopharmaceutical and radioisotope manufacturers, companies that operate commercial nuclear power plants, their suppliers, labor unions and others.

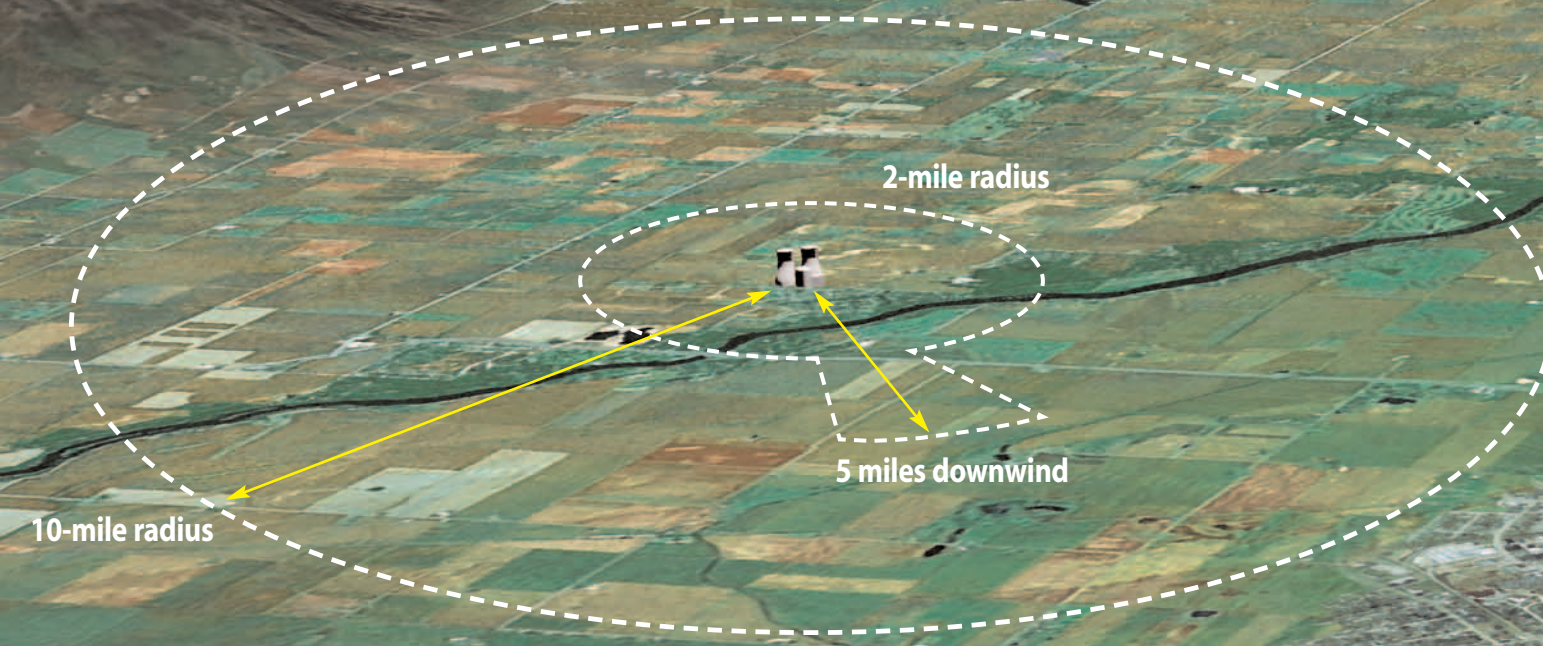


N U C L E A R
E N E R G Y
I N S T I T U T E

1776 I Street, NW
Suite 400
Washington, DC 20006-3708
Phone: 202.739.8000
Fax: 202.785.4019
www.nei.org



Protecting Our Neighbors: Federal Emergency Planning Zones



The federal government established a 10-mile emergency planning zone around each nuclear power plant to protect the public in the event of a serious reactor accident. If evacuation were necessary, emergency responders would focus initially on those citizens likely to be exposed to a potential radioactive release: those within a two-mile radius of the plant, as well as those five miles downwind. This is known as the "keyhole approach."

In the event of an accident that releases radioactivity, specially trained personnel would sample water, milk, soil, crops, livestock and buildings within a 50-mile radius of the plant to determine if any of the material was deposited. If so, they would quarantine contaminated water, milk and food (including livestock feed), and clean up any contamination.

